

Claims

1. A compact self-ballasted electrodeless discharge lamp comprising:

5 a bulb filled with discharge gas containing mercury and a rare gas;

an excitation coil installed near the bulb;

a ballast circuit which supplies high frequency power to the excitation coil; and

a base that is electrically connected to the ballast circuit,

10 wherein: the bulb, the excitation coil, the ballast circuit and the base are formed into an integral part;

the bulb has a virtually spherical shape or a virtually ellipsoidal shape;

a recessed portion to which the excitation coil is inserted is formed on the ballast circuit side of the bulb;

15 the recessed portion has an opening section on the ballast circuit side, and has a tube shape with a virtually round shape in the cross section thereof, with a portion positioned on the side opposite to the opening section of the recessed portion being provided with a function for suppressing the convection of the discharge gas;

20 the largest diameter of the bulb is set in a range from not less than 60 mm to not more than 90 mm;

the bulb wall loading of the bulb during a stable lighting operation is set in a range from not less than 0.07 W/cm^2 to not more than 0.11 W/cm^2 ;

the ratio (h/D) of the height (h) of the bulb based upon the end face of

the opening section in the recessed portion to the largest diameter (D) of the bulb is set in a range from not less than 1.0 to not more than 1.3; and

supposing that a distance between a top face of the recessed portion positioned on the side opposite to the opening section of the recessed portion and a top portion of the bulb facing the top face of the recessed portion is Δh ,
5 and that a diameter of a portion positioned on the side opposite to the opening section of the recessed portion is D_c , the following relationship is satisfied: $\Delta h \leq 1.15 \times D_c + 1.25$ [mm].

10 2. The compact self-ballasted electrodeless discharge lamp of claim 1, wherein the diameter D_c and the distance Δh satisfy the following relationship: $\Delta h \geq 1.16 \times D_c - 17.4$ [mm].

 3. The compact self-ballasted electrodeless discharge lamp of claim
15 1 or 2, wherein the largest diameter of the bulb is set in a range from not less than 65 to not more than 80 mm.

 4. The compact self-ballasted electrodeless discharge lamp of any one of claims 1 to 3, wherein: the excitation coil is constituted by a core and a
20 coil wound around the core; and the center portion of the portion around which the coil is wound in the longitudinal direction of the core is positioned within a range that is apart from a plane on which the largest diameter of the bulb is located by a distance from not less than 8 mm to not more than 20 mm toward the ballast circuit side.

5. A compact self-ballasted electrodeless discharge lamp comprising:

a bulb filled with discharge gas containing mercury and a rare gas;

5 an excitation coil installed near the bulb;

a ballast circuit which supplies high frequency power to the excitation coil; and

a base that is electrically connected to the ballast circuit,

wherein: the bulb, the excitation coil, the ballast circuit and the base
10 are formed into an integral part;

the bulb has a virtually spherical shape or a virtually ellipsoidal shape;

a recessed portion to which the excitation coil is inserted is formed on the ballast circuit side of the bulb;

the recessed portion has an opening section on the ballast circuit side,
15 and has a tube shape with a virtually round shape in the cross section thereof, with a portion positioned on the side opposite to the opening section of the recessed portion being provided with a function for suppressing the convection of the discharge gas;

the largest diameter of the bulb is set in a range from not less than 55
20 mm to not more than 75 mm;

the bulb wall loading of the bulb during a stable lighting operation is set in a range from not less than 0.05 W/cm^2 to less than 0.07 W/cm^2 ;

the ratio (h/D) of the height (h) of the bulb based upon the end face of the opening section in the recessed portion to the largest diameter (D) of the

bulb is set in a range from not less than 1.0 to not more than 1.3; and

supposing that a distance between a top face of the recessed portion positioned on the side opposite to the opening section of the recessed portion and a top portion of the bulb facing the top face of the recessed portion is Δh ,

5 and that a diameter of a portion positioned on the side opposite to the opening section of the recessed portion is D_c , the following relationship is satisfied: $\Delta h \leq 1.92 \times D_c - 22.4$ [mm].

6. The compact self-ballasted electrodeless discharge lamp of claim
10 5, wherein: the diameter D_c and the distance Δh satisfy the following relationship: $\Delta h \geq 1.16 \times D_c - 17.4$ [mm].

7. The compact self-ballasted electrodeless discharge lamp of claim
5 or 6, wherein the largest diameter of the bulb is set in a range from not less
15 than 60 mm to not more than 70 mm.

8. The compact self-ballasted electrodeless discharge lamp of any
one of claims 5 to 7, wherein: the excitation coil is constituted by a core and a
coil wound around the core; and the center portion of the portion around
20 which the coil is wound in the longitudinal direction of the core is virtually
positioned on a plane within which the largest diameter of the bulb is located.

9. The compact self-ballasted electrodeless discharge lamp of any
one of claims 1 to 8, wherein the mercury is enclosed in the bulb not in the

form of amalgam but in the form of mercury element.

10. The compact self-ballasted electrodeless discharge lamp of any one of claims 1 to 9, wherein the filling pressure of the rare gas is set in a
5 range from not less than 60 Pa to not more than 300 Pa.

11. The compact self-ballasted electrodeless discharge lamp of any one of claims 1 to 10, wherein a phosphor layer is formed on an inner surface of the bulb.

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12. The compact self-ballasted electrodeless discharge lamp of any one of claims 1 to 11, wherein the diameter D_c of a portion positioned on the side opposite to the opening section of the recessed portion is greater than the diameter of a portion corresponding to virtually the center portion of the
15 recessed portion in the longitudinal direction of the excitation coil.

13. An electrodeless-discharge-lamp lighting device comprising:
a bulb that is filled with discharge gas containing mercury and a rare gas, and has a recessed portion;
20 an excitation coil inserted in the recessed portion; and
a ballast circuit which supplies high frequency power to the excitation coil,

wherein: the bulb has a virtually spherical shape or a virtually ellipsoidal shape;

the recessed portion has an opening section on the ballast circuit side, and has a tube shape with a virtually round shape in the cross section thereof;

the largest diameter of the bulb is set in a range from not less than 60 mm to not more than 90 mm;

5 the bulb wall loading of the bulb during a stable lighting operation is set in a range from not less than 0.07 W/cm^2 to not more than 0.11 W/cm^2 ;

the ratio (h/D) of the height (h) of the bulb based upon the end face of the opening section in the recessed portion to the largest diameter (D) of the bulb is set in a range from not less than 1.0 to not more than 1.3; and,

10 supposing that a distance between a top face of the recessed portion positioned on the side opposite to the opening section of the recessed portion and a top portion of the bulb facing the top face of the recessed portion is Δh , and that a diameter of a portion positioned on the side opposite to the opening section of the recessed portion is D_c , the following relationship is satisfied: Δh
15 $\leq 1.15 \times D_c + 1.25$ [mm].

14. An electrodeless-discharge-lamp lighting device comprising:

a bulb that is filled with discharge gas containing mercury and a rare gas, and has a recessed portion;

20 an excitation coil inserted in the recessed portion; and

a ballast circuit which supplies high frequency power to the excitation coil,

wherein: the bulb has a virtually spherical shape or a virtually ellipsoidal shape;

the recessed portion has an opening section on the ballast circuit side, and has a virtually cylinder shape with a virtually round tube shape in the cross section thereof;

the largest diameter of the bulb is set in a range from not less than 55
5 mm to not more than 75 mm;

the bulb wall loading of the bulb during a stable lighting operation is set in a range from not less than 0.05 W/cm^2 to less than 0.07 W/cm^2 ;

the ratio (h/D) of the height (h) of the bulb based upon the end face of the opening section in the recessed portion to the largest diameter (D) of the
10 bulb is set in a range from not less than 1.0 to not more than 1.3; and,

supposing that a distance between a top face of the recessed portion positioned on the side opposite to the opening section of the recessed portion and a top portion of the bulb facing the top face of the recessed portion is Δh , and that a diameter of a portion positioned on the side opposite to the opening
15 section of the recessed portion is D_c , the following relationship is satisfied: $\Delta h \leq 1.92 \times D_c - 22.4$ [mm].

15. The electrodeless-discharge-lamp lighting device of claim 13 or 14, wherein the diameter D_c of a portion positioned on the side opposite to
20 the opening section of the recessed portion is greater than the diameter of a portion corresponding to virtually the center portion of the recessed portion in the longitudinal direction of the induction coil.

ABSTRACT

The present invention relates to a compact self-ballasted electrodeless discharge lamp in which: the largest diameter of a bulb **101** is set in a range from not less than 60 mm to not more than 90 mm and the bulb wall loading of the bulb **101** is set in a range from not less than 0.07 W/cm² to not more than 0.11 W/cm²; and in this structure, the diameter Dc of the recessed portion **102** and the distance Δh between the top of the recessed portion **102** and the top portion of the bulb **101** are allowed to satisfy the following relationship: $\Delta h \leq 1.15 \times Dc + 1.25$ [mm].